

Derivation of Plutonium-239 Materials Disposition Categories

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April 27, 1995



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Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

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April 27, 1995

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Abstract

At this time, the Office of Fissile Materials Disposition within the DOE, is assessing alternatives for the disposition of excess fissile materials. To facilitate the assessment, the *Plutonium-Bearing Materials Feed Report for the DOE Fissile Materials Disposition Program Alternatives (U)*¹ was written. The development of the material categories and the derivation of the inventory quantities associated with those categories is documented in this report.

Pre-Existing Material Categories

The DOE inventory of plutonium exists in a number of different forms (i.e., metals, alloys, and compounds), and in varying degrees of isotopic enrichment and chemical purity. The material form, enrichment, and types and levels of impurities are considered when deciding the appropriate disposition of any excess plutonium. Material categories were devised to facilitate the characterization of processing requirements for dispositioning material through any given disposition alternative.

The basic inventory data is available at the site level, and at the DOE-wide level within the Office of Arms Control and Nonproliferation, which maintains the Nuclear Materials Management and Safeguards System (NMMSS). The individual site databases maintain detailed information on each physical inventory item, but the individual site categorization schemes are not standardized or consistent from site to site. The NMMSS provides less detailed information on materials, but is, instead, summarized by a uniform set of categories. In reporting to the NMMSS, each site summarizes (individual physical items are not reported) and categorizes its data using the NMMSS scheme. Given the inherent difficulty in correlating and assessing information from the site databases, and the desire to maintain consistency with the DOE-wide plutonium inventory database, the NMMSS database was used as the basis for the feed report. The NMMSS has a categorization scheme that identifies ranges of isotopic enrichment, the general makeup of the plutonium inventory based on the most recent processing activity, and the program for which the material is being provided.

Seven isotopic assay categories are used in the NMMSS database to identify the isotopic assay of ²⁴⁰Pu in the Plutonium-239 material. This characteristic is used to differentiate weapons-grade plutonium from reactor-grade plutonium. The Isotopic Range Codes, or Material Types, 51 and 52 are considered weapons-grade. The assay ranges for the isotopic assay categories are given in the following table:

Isotopic Range Code	Range (% ²⁴⁰ Pu)
51	<4.00
52	4.00 to <7.00
53	7.00 to <10.00
54	10.00 to <13.00
55	13.00 to < 16.00
56	16.00 to < 20.00
57	20.00 and above

Table 1. Isotopic Assay Range Codes for Plutonium-239.

The general makeup of plutonium in the NMMSS database is cataloged into one of approximately 40 main categories and 200 sub categories known as Composition of Ending Inventory (COEI) codes. Additionally, the seven sub categories for Unirradiated Scrap Material Awaiting Recovery (COEIs

¹UCRL-ID-120749, Winslow G. Brough (LLNL), Stephen T. Boerigter (LANL), April 6, 1995

721-722, and 725-729), are further subdivided into another approximately 130 sub categories, called ANSI scrap codes (referring to the American National Standards Institute ANSI N15.10-1987).

For the most part, the NMMSS COEI codes and descriptors did not sufficiently characterize the plutonium inventory to easily identify processing requirements for the purposes of material disposition. The ANSI scrap codes provided more detailed descriptions for those materials identified as scrap, but the NMMSS database was still lacking information pertaining to the levels of alloying constituents and impurities. Other sources of information from the sites and from DP-22 were used to gain a better understanding of typical alloying constituents and impurities.

In a search for a Materials Disposition categorization scheme, individual site item description codes (e.g., RFP's IDC, LANL's IDES, and LLNL's forms and shapes) were reviewed and found inconsistent for a DOE-wide assessment and roll-up. It was decided to start with a categorization scheme used by the DOE Defense Programs (DP-22) that used nine main categories. Specific COEI, ANSI, and project codes had been assigned to the nine main categories as shown in **Table 2**. Not only were the DP-22 categories close to the needs of Materials Disposition, but by using the DP-22 categories, it helped in separating those materials that were excess to Defense Programs from those that were not.

DP-22 Category	COEI and ANSI codes included in category
Pits	309 (-GB- only), 580, 581, 582, 699, 772
Metal -- Unalloyed	132, 134, 145, 147, 148, 150, 152, 154, 164* , 165, 167, 169, 180, 182, 184, 195, 197, 200, 204, 206, 220, 222, 224, 236, 237, 238, 251, 252, 254, 305 (-GB-), 308 (-GB-), 450, 690, 701, 721 (A00, A02, & A03), 778, 779, 782
Metal -- Alloyed	133, 146, 149, 151, 153, 155, 166, 168, 170, 181, 183, 185, 196, 198, 201, 205, 207, 221, 223, 225, 253, 255, 256, 257, 306 (-GB-), 691, 702, 722 (B00, B02, B03, B11, B40, B70, & B90), 780, 783
Oxides	060, 061, 062, 235, 287, 289, 453, 454, 455, 456, 457, 635, 636, 637, 709, 710*, 725 (C00, C01, C02, C41, C71, & C90)
Other Compounds	063, 064, 081, 082, 083, 130, 131, 410, 572, 692, 770, 775, 776, 784
Nitrate Solutions	409, 452, 703
R&D, Reactor Fuel, and Miscellaneous	285, 286*, 288, 290, 291, 305 (non-GB-), 306 (non-GB-), 307 (non-GB-), 309 (non-GB-), 481, 745, 746, 747, 748, 749, 752, 771, 774, 781, 785, 788, 789, 836
Scrap / Residues	693, 694, 695, 696, 697, 700, 721 (except A00, A02, & A03), 722 (except B00, B02, B03, B11, B40, B70, & B90), 725 (except C00, C01, C02, C41, C71, & C90), 726, 727, 728, 729, 777, 791
Irradiated Fuel	360, 362, 363, 375, 376, 385, 386, 387, 389, 390, 391, 392, 405, 408, 790

Table 2. DP-22 Plutonium Composition Categories by COEI² and ANSI³ Codes

DOE Material Disposition Categories

The nine DOE/DP-22 categories were expanded to eleven categories for the DOE/MD categorization scheme. Those eleven categories and their sub categories are defined in the feed report. **Figure 3** shows the general migration paths of the NMMSS codes from the nine DOE/DP-22 categories (plus a tenth Section 91B category) to the eleven DOE/MD categories. **Table 3** lists the actual NMMSS codes used for each of the eleven main categories and their sub categories.

* Not an authorized COEI for Plutonium per NMMSS I-17 Report

²COEI is 'Composition of Ending Inventory' as defined by NMMSS I-17 Report

³ANSI is American National Standards Institute , Unirradiated Pu Scrap -- Classification, ANSI N15.10 - 1987

To the right of **Table 3** are those COEI and ANSI codes that were not included in the DOE/MD categories because of the lack of significant quantities of those specific materials, and due to the necessity of getting a baseline inventory established quickly.

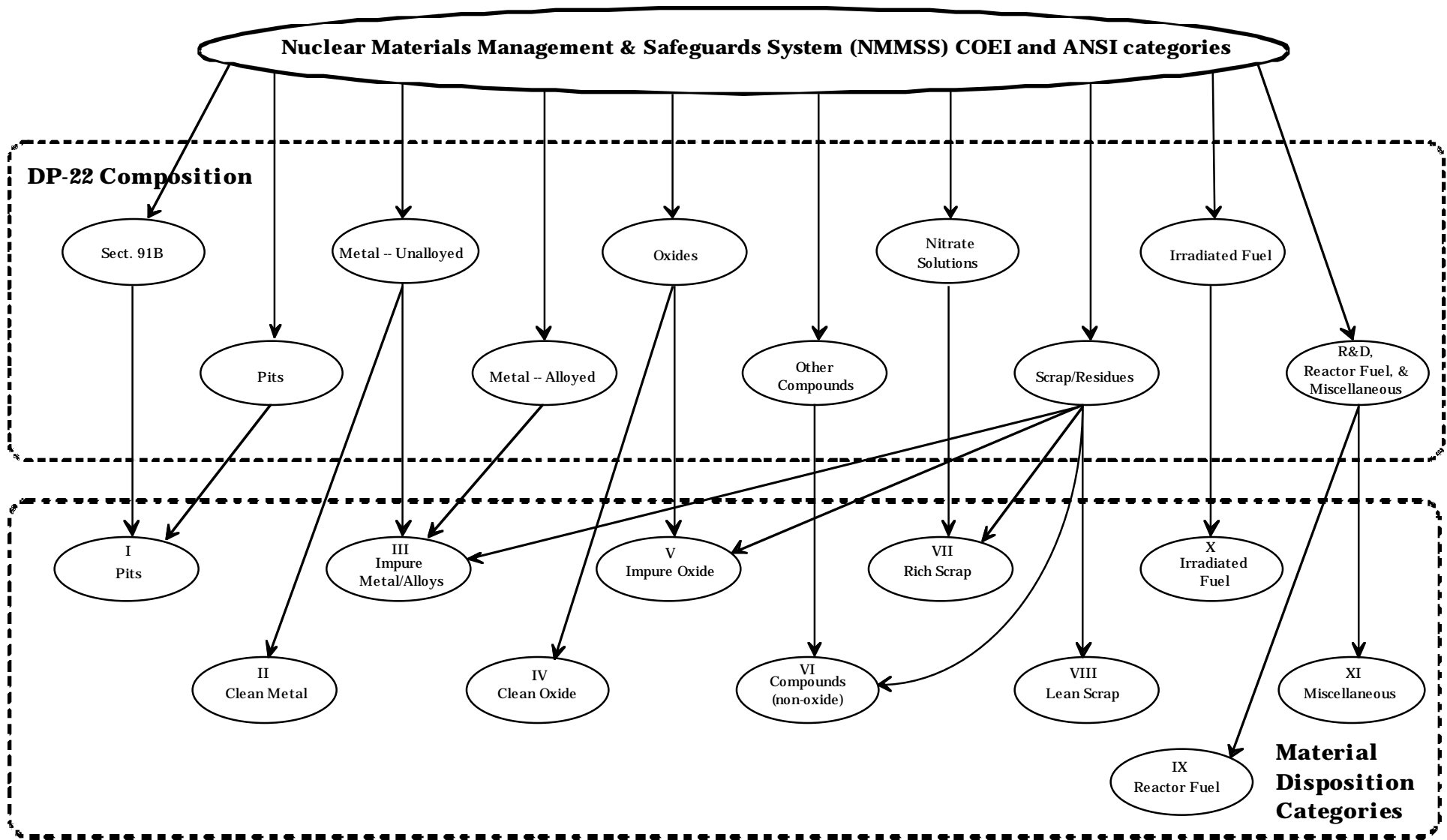


Figure 1. Mapping of DOE/DP-22 Categories to DOE/MD Categories

Table 3. Mapping of COEI and ANSI Codes to Material Disposition Categories

Category	Sub Category	Description	COEI	ANSI	Comments
I. Pits					
Sub Categories derived from data external to NMMSS					
			309 (-GB- only)		Not yet included: 699
			580		
			581		
			582		
			772		
			837		move to Miscellaneous??
			903		
			905		
			911		move to Miscellaneous??
			912		move to Miscellaneous??
II. Clean Metal					
	1	Buttons	132		Not yet included; subs not identified:
			145		134 251
					147 252
					148 254
	2	Billets, Ingots, Castings, & Rough Machining	150		152 308 (-GB-)
			154		165 450
			169		167 778
			195		180
			206		182
					184
	3	Weapon Components	224		197
			305 (-GB- only)		200
					204
	4	Recovered Metal, & Misc. Small Parts	690		220
			701		222
			779		236
			782		237
					238
III. Impure Metal/Alloys					
	1	Alloys	133		Not yet included; subs not identified:
			146		149
			151		153
			155		166
			170		168
			196		181
			207		183
			225		185
			257		198
			306 (-GB- only)		201
			702		205
			722	B00	221
			722	B02	223
			722	B03	253
			722	B04	255
			722	B10	256
			722	B11	691
			722	B13	
			722	B20	
			722	B34	
			722	B40	
			722	B41	
			722	B50	
			722	B70	

Category	Sub Category	Description	COEI	ANSI	Comments
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			722	B80
			722	B90
			780	
			783	
	2	Impure Unalloyed Metal	721	A00
			721	A01
			721	A02
			721	A03
			721	A04

IV. Clean Oxide

	no sub categories		453	
			454	
			455	

Not yet included:

060, 061, 062, 235, 287,
289, 456, 457, 635, 636,
637, 709

V. Impure Oxide

	1	Oxides	697	
			725	C00
			725	C01
			725	C02
	2	Pu-DU/NU Oxides	725	C40
			725	C41
			725	C43
			725	C50
			725	C51
			725	C52
	3	Pu-EU Oxides	725	C70
			725	C71
			725	C72
			727	E70
	4	Pu-Np Oxides	725	C90
	5	Pu-Th Oxides	725	C80
	6	Pu-Be Oxides	725	C03
	7	Pu-Zr Oxides	725	C04

This COEI belongs in Rich Scrap, Non-Conforming Scrap???

VI. Compounds (non-oxide)

	1	Carbides	725	C25
	2	Hydrides	725	C26
	3	Nitrides	725	C27
			725	C77
	4	Halides	725	C54
	5	Encapsulated Compounds	725	C30
	6	Misc. Compounds	776	
			784	

Not yet included; subs not identified:

063
064
081
082
083
130
131
410
572
692
770
775

VII. Rich Scrap

	1	Graphite	725	C75
			726	D04
			727	E04

Not yet included; subs not identified:

Includes Lean Scrap 452
Includes Lean Scrap 693
Includes Lean Scrap 694

Category	Sub Category	Description	COEI	ANSI	Comments
					695
					696
	2	Ash/ Ash and Soot Heels	729	G03	Includes Lean Scrap 697
			729	G73	Includes Lean Scrap
			729	G93	Includes Lean Scrap
					721 (A05)
					722 (except B00, B02, B03, B04, B10, B11, B13, B40, B70, B90)
	3	Heels	729	G01	Includes Lean Scrap
					725 (all others except C00, C01, C02, C25, C26, C27, C30, C41, C71, C90)
	4	Pu Fluorides	725	C10	
			725	C11	
			725	C12	
					729 (all others except G04)
	5	Sand, Slag, &Crucible (SS&C)	729	G05	Includes Lean Scrap
					777
	6	Insulation - Filters	727	E03	Includes Lean Scrap
			727	E05	Includes Lean Scrap
	7	Ceramics	No COEI in NMMSS		Includes Lean Scrap
	8	Sludge	729	G02	Includes Lean Scrap
			729	G40	Includes Lean Scrap
			729	G70	Includes Lean Scrap
			729	G90	Includes Lean Scrap
			729	G92	Includes Lean Scrap
	9	Chloride Salts/ Chloride-Containing Oxides	725	C13	Includes Lean Scrap
			729	G20	Includes Lean Scrap
	10	Solutions	409		Includes Lean Scrap
			700		Includes Lean Scrap
			703		Includes Lean Scrap
			728	F00	Includes Lean Scrap
			728	F01	Includes Lean Scrap
			728	F02	Includes Lean Scrap
			728	F03	Includes Lean Scrap
			728	F04	Includes Lean Scrap
			728	F05	Includes Lean Scrap
			728	F06	Includes Lean Scrap
			728	F07	Includes Lean Scrap
			728	F40	Includes Lean Scrap
			728	F50	Includes Lean Scrap
			728	F70	Includes Lean Scrap
			728	F80	Includes Lean Scrap
			728	F90	Includes Lean Scrap
	11	Non Conforming Scrap			
			729	G00	Includes Lean Scrap

VIII. Lean Scrap

	1	Graphite	see Rich Scrap	Reported with Rich Scrap
	2	Combustibles	726	D00
			726	D01
			726	D02
			726	D03
			726	D40

Category	Sub Category	Description	COEI	ANSI	Comments
			726	D50	
			726	D70	
			726	D80	
			726	D90	
	3	Ash/ Ash and Soot Heels	see Rich Scrap		Reported with Rich Scrap
	4	Heels	see Rich Scrap		Reported with Rich Scrap
	5	Sand, Slag, & Crucible (SS&C)	see Rich Scrap		Reported with Rich Scrap
	6	Insulation - Filters	see Rich Scrap		Reported with Rich Scrap
	7	Ceramics	see Rich Scrap		Reported with Rich Scrap
	8	Scrap Metal	727	E00	
			727	E01	
			727	E02	
			727	E06	
			791		
	9	Glass	727	E07	
	10	Leaded Gloves	No COEI in NMMSS		
	11	Grit Blast Residues	729	G04	
	12	Sludge	see Rich Scrap		Reported with Rich Scrap
	13	Chloride Salts/ Chloride-Containing Oxides	see Rich Scrap		Reported with Rich Scrap
	14	Fire Brick/ LECO Crucibles	727	E08	
	15	Ion Exchange Resins	No COEI in NMMSS		
	16	Solutions	see Rich Scrap		Reported with Rich Scrap
	17	Non-Conforming Scrap	see Rich Scrap		Reported with Rich Scrap

IX. Reactor Fuel

			285	
			290	
			291	

X. Irradiated Fuel

			360	
			375	
			376	
			385	
			386	
			387	
			390	
			391	
			392	
			405	
			408	
			790	

Not yet included:

362
363
389

Category	Sub Category	Description	COEI	ANSI	Comments
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XI. Miscellaneous

	1	Pu-Al Alloy	TBD	
	2	Pu-U-Mo Alloy	774	
	3	Mixed Oxide	306 (non-GB-)	
			309 (non-GB-)	
			481	
			745	
			746	
			752	
			771	
			781	
			785	
			788	
			836	

Not yet included; subs not identified:

288
305 (non -GB-)
307 (non -GB-)
747
748
749
789

The Material Disposition Categories were formulated to identify potential processing requirements for disposition activities, which might result in separation, purification, volume reduction, stabilization, or immobilization of the material. Any specific material item in the inventory can have several material attributes that will qualify it for a couple of material categories. An attempt was made to avoid this problem, but because of the need to work with some of the pre-existing categories, it was not entirely possible. This made it necessary to generate a sort order algorithm that would provide consistency in how the material is cataloged.

The sort order algorithm of material is as show in **Figure 2**. The first major sort identifies materials that have been assembled into Pits. It does not matter whether or not a pit is in an assembled weapon. The second major sort identifies Irradiated Fuel. Some material that received very little radiation, resulting in negligible fission products is identified as Miscellaneous material. The third major sort identifies Reactor Fuel. The sorting algorithm then determines the level of impurities in the remaining materials, and groups it into Lean Scrap, Rich Scrap, or (Oxide, Compound, or Metal/Alloy) if the impurity levels are minimal. Several exceptions to this sort algorithm allows for consideration of some specific materials as shown in **Figure 2**.

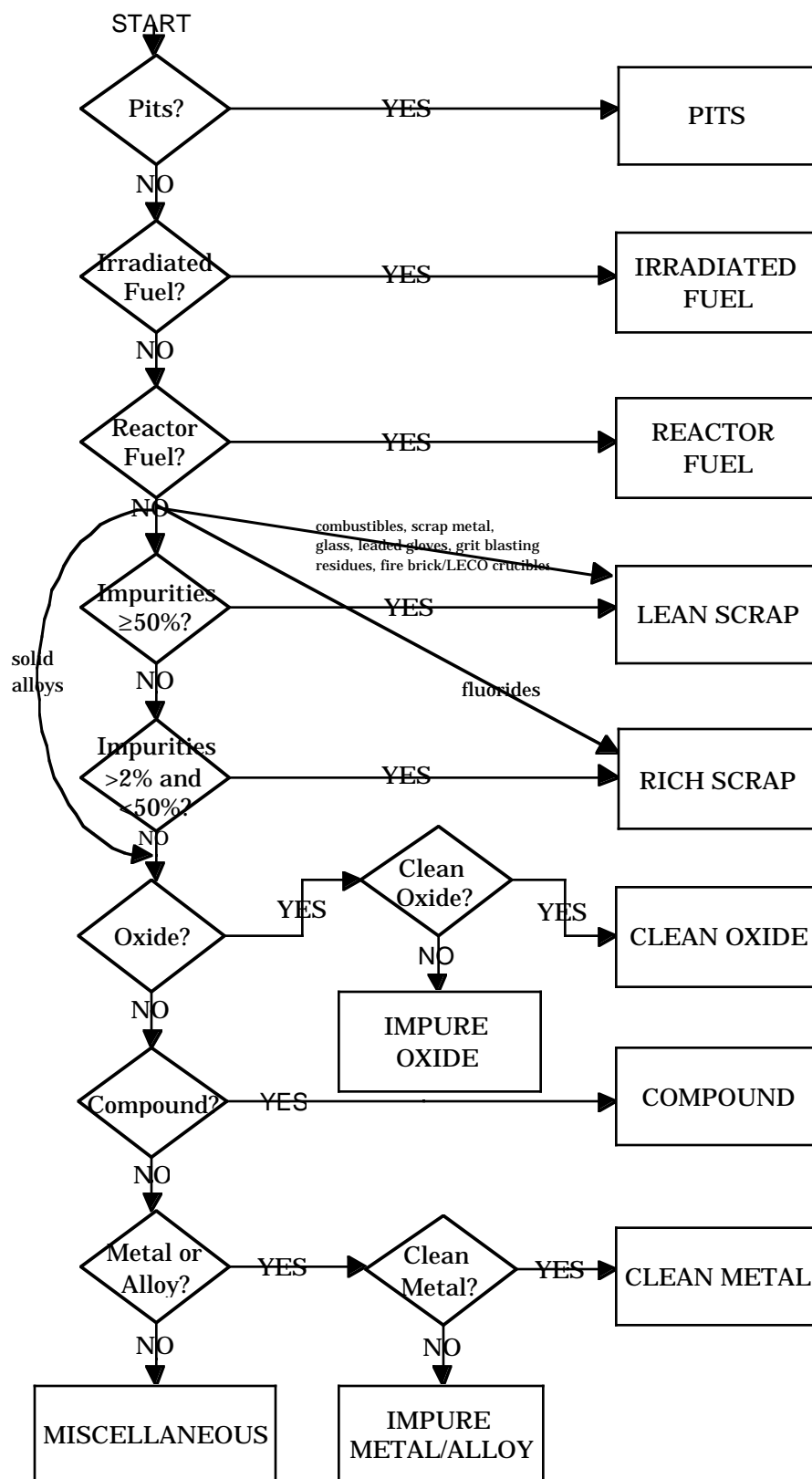


Figure 2. DOE/MD Category Sort Order

Database Platforms

The DOE/DP-22 database is installed on an Apple Macintosh platform using 4th Dimension database software. The DOE/MD database was set up on two separate platforms -- a Macintosh using 4th Dimension, and a Macintosh using Microsoft's FoxPro. The purpose of using the FoxPro database platform was to test the capability to import and manipulate the NMMSS data. FoxPro can be run on either an IBM or Macintosh platform, and both the NAC NMMSS database conversion project and the DOE/AL field office are developing database systems on an IBM platform using FoxPro.

Numerical Calculations

The material categories were added to the DP-22 (slightly modified NMMSS) database, and then subtotals were derived through queries. The summary tables for the feed report were generated with Microsoft's Excel spreadsheet from data extracted from the database systems. The Pits subcategory totals were generated using the 95-1 P&PD data entered into an Excel spreadsheet.

The category totals for Rich Scrap and Lean Scrap was not as straightforward as were the other categories. The proper category for a candidate material sometimes depended on the level of impurities, which is not provided in the NMMSS database. Therefore the candidate materials for Rich Scrap and Lean Scrap were divided into three categories -- Rich Scrap, Rich+Lean Scrap, and Lean Scrap. The NMMSS database could total those separately. Then information from the Rocky Flats site database was used to ascertain the ratio of Rich-to-Lean in the Rich+Lean category. That ratio was then used to split the Rich+Lean Scrap total into Rich Scrap and Lean Scrap. Those new values were then added to the known quantities of Rich Scrap and Lean Scrap from the NMMSS totals to derive the final numbers for the Rich Scrap and Lean Scrap categories. That ratio was applied to all the other sites as well, as the actual ratios for the other sites were not available.

Remaining Work

The work that was performed in support of the feed report provided sufficient information for disposition alternatives to initiate process flow diagrams and assess the requirements for processing the various categories of materials. Only the NMMSS material categories with significant quantities of reported material were evaluated. **Table 3** lists the COEI codes that are used for plutonium, and indicates which of the codes were mapped into the DOE/MD categories. The remaining COEI codes should be mapped into the DOE/MD categories so that categories that may later receive significant quantities of material will show up in the appropriate categories. The same is true for the ANSI scrap codes as shown in **Table 3**. A complete listing of all ANSI plutonium scrap codes is provided in **Table 4**, and a complete listing of all material type 50 (Pu-239) COEI entry codes is provided in **Table 5**. From **Tables 4** and **5** it can be seen which codes have not been mapped into the DOE/MD categories.

Additional work will need to be done to make a viable materials database system for the Materials Disposition program. A discussion of the issues and recommendations for a multi-year effort have been forwarded as an R&D proposal to the DOE/MD.

Table 4. Mapping of ANSI Scrap Codes to DOE/MD Categories -- Sorted by ANSI.

MD Main Category Number	Materials Disposition Main Category Title	MD Sub Category Number	MD Sub Category Title	COEI	ANSI Scrap Code	ANSI Form
III	Impure Metal/Alloys	2	Impure Unalloyed Metal	721	A00	Unalloyed Metal
III	Impure Metal/Alloys	2	Impure Unalloyed Metal	721	A01	Unalloyed Metal
III	Impure Metal/Alloys	2	Impure Unalloyed Metal	721	A02	Unalloyed Metal
III	Impure Metal/Alloys	2	Impure Unalloyed Metal	721	A03	Unalloyed Metal
III	Impure Metal/Alloys	2	Impure Unalloyed Metal	721	A04	Unalloyed Metal
?	?	?	?	721	A05	Unalloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B00	Alloyed Metal
?	?	?	?	722	B01	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B02	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B03	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B04	Alloyed Metal
?	?	?	?	722	B05	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B10	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B11	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B13	Alloyed Metal
?	?	?	?	722	B14	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B20	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B34	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B40	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B41	Alloyed Metal
?	?	?	?	722	B49	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B50	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B70	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B80	Alloyed Metal
III	Impure Metal/Alloys	1	Alloys	722	B90	Alloyed Metal
V	Impure Oxide	1	Oxides	725	C00	Compounds
V	Impure Oxide	1	Oxides	725	C01	Compounds
V	Impure Oxide	1	Oxides	725	C02	Compounds
V	Impure Oxide	6	Pu-Be Oxides	725	C03	Compounds

MD Main Category Number	Materials Disposition Main Category Title	MD Sub Category Number	MD Sub Category Title	COEI	ANSI Scrap Code	ANSI Form
V	Impure Oxide	7	Pu-Zr Oxides	725	C04	Compounds
VII	Rich Scrap	4	Plutonium Fluorides	725	C10	Compounds
VII	Rich Scrap	4	Plutonium Fluorides	725	C11	Compounds
VII	Rich Scrap	4	Plutonium Fluorides	725	C12	Compounds
VII	Rich Scrap	9	Chloride Salts / Chloride-Containing Oxides	725	C13	Compounds
?	?	?	?	725	C14	Compounds
VI	Compounds (non oxides)	1	Carbides	725	C25	Compounds
VI	Compounds (non oxides)	2	Hydrides	725	C26	Compounds
VI	Compounds (non oxides)	3	Nitrides	725	C27	Compounds
VI	Compounds (non oxides)	5	Encapsulated Compounds	725	C30	Compounds
V	Impure Oxide	2	Pu-DU/NU Oxides	725	C40	Compounds
V	Impure Oxide	2	Pu-DU/NU Oxides	725	C41	Compounds
V	Impure Oxide	2	Pu-DU/NU Oxides	725	C43	Compounds
?	?	?	?	725	C44	Compounds
?	?	?	?	725	C45	Compounds
?	?	?	?	725	C46	Compounds
?	?	?	?	725	C47	Compounds
V	Impure Oxide	2	Pu-DU/NU Oxides	725	C50	Compounds
V	Impure Oxide	2	Pu-DU/NU Oxides	725	C51	Compounds
V	Impure Oxide	2	Pu-DU/NU Oxides	725	C52	Compounds
VI	Compounds (non oxides)	4	Halides	725	C54	Compounds
?	?	?	?	725	C55	Compounds
?	?	?	?	725	C56	Compounds
?	?	?	?	725	C57	Compounds
V	Impure Oxide	3	Pu-EU Oxides	725	C70	Compounds
V	Impure Oxide	3	Pu-EU Oxides	725	C71	Compounds
V	Impure Oxide	3	Pu-EU Oxides	725	C72	Compounds
?	?	?	?	725	C74	Compounds
VII	Rich Scrap	1	Graphite	725	C75	Compounds
?	?	?	?	725	C76	Compounds

MD Main Category Number	Materials Disposition Main Category Title	MD Sub Category Number	MD Sub Category Title	COEI	ANSI Scrap Code	ANSI Form
VI	Compounds (non oxides)	3	Nitrides	725	C77	Compounds
V	Impure Oxide	5	Pu-Th Oxides	725	C80	Compounds
?	?	?	?	725	C81	Compounds
?	?	?	?	725	C82	Compounds
V	Impure Oxide	4	Pu-Np Oxides	725	C90	Compounds
VIII	Lean Scrap	2	Combustibles	726	D00	Combustibles
VIII	Lean Scrap	2	Combustibles	726	D01	Combustibles
VIII	Lean Scrap	2	Combustibles	726	D02	Combustibles
VIII	Lean Scrap	2	Combustibles	726	D03	Combustibles
VII	Rich Scrap	1	Graphite	726	D04	Combustibles
VIII	Lean Scrap	2	Combustibles	726	D40	Combustibles
VIII	Lean Scrap	2	Combustibles	726	D50	Combustibles
VIII	Lean Scrap	2	Combustibles	726	D70	Combustibles
VIII	Lean Scrap	2	Combustibles	726	D80	Combustibles
VIII	Lean Scrap	2	Combustibles	726	D90	Combustibles
VIII	Lean Scrap	8	Scrap Metal	727	E00	Noncombustibles
VIII	Lean Scrap	8	Scrap Metal	727	E01	Noncombustibles
VIII	Lean Scrap	8	Scrap Metal	727	E02	Noncombustibles
VII	Rich Scrap	6	Insulation - Filters	727	E03	Noncombustibles
VII	Rich Scrap	1	Graphite	727	E04	Noncombustibles
VII	Rich Scrap	6	Insulation - Filters	727	E05	Noncombustibles
VIII	Lean Scrap	8	Scrap Metal	727	E06	Noncombustibles
VIII	Lean Scrap	9	Glass	727	E07	Noncombustibles
VIII	Lean Scrap	14	Fire Brick / LECO Crucibles	727	E08	Noncombustibles
?	?	?	?	727	E09	Noncombustibles
?	?	?	?	727	E40	Noncombustibles
?	?	?	?	727	E50	Noncombustibles
V	Impure Oxide	3	Pu-EU Oxides	727	E70	Noncombustibles
?	?	?	?	727	E80	Noncombustibles
?	?	?	?	727	E90	Noncombustibles

MD Main Category Number	Materials Disposition Main Category Title	MD Sub Category Number	MD Sub Category Title	COEI	ANSI Scrap Code	ANSI Form
VII	Rich Scrap	10	Solutions	728	F00	Solutions
VII	Rich Scrap	10	Solutions	728	F01	Solutions
VII	Rich Scrap	10	Solutions	728	F02	Solutions
VII	Rich Scrap	10	Solutions	728	F03	Solutions
VII	Rich Scrap	10	Solutions	728	F04	Solutions
VII	Rich Scrap	10	Solutions	728	F05	Solutions
VII	Rich Scrap	10	Solutions	728	F06	Solutions
VII	Rich Scrap	10	Solutions	728	F07	Solutions
VII	Rich Scrap	10	Solutions	728	F40	Solutions
VII	Rich Scrap	10	Solutions	728	F50	Solutions
VII	Rich Scrap	10	Solutions	728	F70	Solutions
VII	Rich Scrap	10	Solutions	728	F80	Solutions
VII	Rich Scrap	10	Solutions	728	F90	Solutions
VII	Rich Scrap	11	Non-Conforming Scrap	729	G00	Process Residues
VII	Rich Scrap	3	Heels	729	G01	Process Residues
VII	Rich Scrap	8	Sludge	729	G02	Process Residues
VII	Rich Scrap	2	Ash/Ash & Soot Heels	729	G03	Process Residues
VIII	Lean Scrap	11	Grit Blasting Residues	729	G04	Process Residues
VII	Rich Scrap	5	Sand, Slag, and Crucible (SS&C)	729	G05	Process Residues
?	?	?	?	729	G10	Process Residues
VII	Rich Scrap	9	Chloride Salts / Chloride-Containing Oxides	729	G20	Process Residues
VII	Rich Scrap	8	Sludge	729	G40	Process Residues
?	?	?	?	729	G41	Process Residues
?	?	?	?	729	G42	Process Residues
?	?	?	?	729	G43	Process Residues
?	?	?	?	729	G50	Process Residues
?	?	?	?	729	G51	Process Residues
?	?	?	?	729	G52	Process Residues

MD Main Category Number	Materials Disposition Main Category Title	MD Sub Category Number	MD Sub Category Title	COEI	ANSI Scrap Code	ANSI Form
?	?	?	?	729	G53	Process Residues
?	?	?	?	729	G57	Process Residues
?	?	?	?	729	G58	Process Residues
VII	Rich Scrap	8	Sludge	729	G70	Process Residues
?	?	?	?	729	G71	Process Residues
?	?	?	?	729	G72	Process Residues
VII	Rich Scrap	2	Ash/Ash & Soot Heels	729	G73	Process Residues
?	?	?	?	729	G80	Process Residues
?	?	?	?	729	G81	Process Residues
?	?	?	?	729	G82	Process Residues
?	?	?	?	729	G83	Process Residues
VII	Rich Scrap	8	Sludge	729	G90	Process Residues
?	?	?	?	729	G91	Process Residues
VII	Rich Scrap	8	Sludge	729	G92	Process Residues
VII	Rich Scrap	2	Ash/Ash & Soot Heels	729	G93	Process Residues

Table 5. Mapping of COEI Codes to DOE/MD Categories -- Sorted by COEI.

DOE/MD Category	COEI Code	Composition of Ending Inventory (COEI) Description
IV.?	060	TRIOXIDE FEED
IV.?	061	DIOXIDE FEED
IV.?	062	OTHER OXIDE FEED
VI.?	063	IN HYDROFLUORINATION PROCESS
VI.?	064	TETRAFLUORIDE PRODUCT
VI.?	081	TETRAFLUORIDE FEED
VI.?	082	IN FLUORINATION PROCESS
VI.?	083	HEXAFLUORIDE PRODUCT
VI.?	130	TETRAFLUORIDE FEED
VI.?	131	IN REDUCTION PROCESS
II.1	132	UNALLOYED BUTTONS PRODUCT
III.1	133	ALLOYED BUTTONS PRODUCT
II.?	134	DERBIES PRODUCT
II.1	145	UNALLOYED BUTTONS FEED
III.1	146	ALLOYED BUTTONS FEED
II.?	147	DERBIES FEED
II.?	148	UNALLOYED BRIQUETTES FEED
III.?	149	ALLOYED BRIQUETTES FEED
II.2	150	UNALLOYED METAL FEED
III.1	151	ALLOYED METAL FEED
II.?	152	IN CASTING PROCESS-UNALLOYED
III.?	153	IN CASTING PROCESS-ALLOYED
II.2	154	UNALLOYED CASTINGS PRODUCT
III.1	155	ALLOYED CASTINGS PRODUCT
II.?	165	UNALLOYED CASTINGS FEED
III.?	166	ALLOYED CASTINGS FEED
II.?	167	IN UNALLOYED ROUGH MACHINING PROCESS
III.?	168	IN ALLOYED ROUGH MACHINING PROCESS
II.2	169	UNALLOYED ROUGH MACHINED ITEMS PRODUCT
III.1	170	ALLOYED ROUGH MACHINED ITEMS PRODUCT
II.?	180	UNALLOYED MACHINE TURNINGS FEED
III.?	181	ALLOYED MACHINE TURNINGS FEED
II.?	182	BRIQUETTING PROCESS-UNALLOYED
III.?	183	BRIQUETTING PROCESS-ALLOYED
II.?	184	UNALLOYED BRIQUETTES PRODUCT
III.?	185	ALLOYED BRIQUETTES PRODUCT
II.2	195	UNALLOYED INGOTS FEED
III.1	196	ALLOYED INGOTS FEED
II.?	197	UNALLOYED CASTINGS FEED
III.?	198	ALLOYED CASTINGS FEED
II.?	200	UNALLOYED ROUGH MACHINED ITEMS FEED
III.?	201	ALLOYED ROUGH MACHINED ITEMS FEED
II.?	204	IN FORMING PROCESS-UNALLOYED
III.?	205	IN FORMING PROCESS-ALLOYED
II.2	206	UNALLOYED FORMED ITEMS PRODUCT
III.1	207	ALLOYED FORMED ITEMS PRODUCT
II.?	220	UNALLOYED ROUGH MACHINED ITEMS FEED
III.?	221	ALLOYED ROUGH MACHINED ITEMS FEED
II.?	222	IN FINISH MACHINING PROCESS-UNALLOYED
III.?	223	IN FINISH MACHINING PROCESS-ALLOYED
II.3	224	UNALLOYED FINISH MACHINED ITEMS PRODUCT
III.1	225	ALLOYED FINISH MACHINED ITEMS PRODUCT
IV.?	235	OXIDE FEED
II.?	236	METAL FEED

DOE/MD Category	COEI Code	Composition of Ending Inventory (COEI) Description
II.?	237	IN BILLET FABRICATION PROCESS
II.?	238	BILLETS PRODUCT
II.?	251	FORMED ITEMS FEED
II.?	252	UNALLOYED ROUGH MACHINED ITEMS FEED
III.?	253	ALLOYED ROUGH MACHINED ITEMS FEED
II.?	254	UNALLOYED FINISH MACHINED ITEMS FEED
III.?	255	ALLOYED FINISH MACHINED ITEMS FEED
III.?	256	IN CANNING & CLADDING PROCESS
III.1	257	CANNED & CLAD ITEMS PRODUCT
IX.0	285	FORMED ITEMS FEED
IV.?	287	SPECIAL FUELS OXIDE FEED
XI.?	288	CANNED & CLAD ITEMS FEED
IV.?	289	SINTERED PRODUCTS FEED
IX.0	290	IN FUEL ELEMENT AND TARGET FABR. PROCESS
IX.0	291	FABRICATED FUEL ELEMENTS & TARGETS PRODUCT
II.3	305(GB)	UNALLOYED FINISH MACHINED ITEMS FEED
XI.?	305(nGB)	UNALLOYED FINISH MACHINED ITEMS FEED
III.1	306(GB)	ALLOYED FINISH MACHINED ITEMS FEED
XI.3	306(nGB)	ALLOYED FINISH MACHINED ITEMS FEED
??	307(GB)	FABRICATED FUEL ELEMENT, TARGET & PINS FEED
XI.?	307(nGB)	FABRICATED FUEL ELEMENT, TARGET & PINS FEED
II.?	308(GB)	IN ASSEMBLY PROCESS
??	308(nGB)	IN ASSEMBLY PROCESS
I.0	309(GB)	ASSEMBLED ITEMS PRODUCT
XI.3	309(nGB)	ASSEMBLED ITEMS PRODUCT
X.0	360	IN REACTOR, FUEL
X.?	362	IN REACTOR, TARGETS
X.?	363	IN REACTOR, PRODUCT
X.0	375	IRRADIATED RECYCLABLE FUEL
X.0	376	IN COOLING, PRODUCT
X.0	385	ALUMINUM PROCESS(IRRADIATED)
X.0	386	ZIRCONIUM PROCESS(IRRADIATED)
X.0	387	ELECTROLYTIC PROCESS(IRRADIATED)
X.?	389	U-233 PROCESS(IRRADIATED)
X.0	390	FLUORINEL PROCESS(IRRADIATED)
X.0	391	CUSTOM OR SPECIAL PROCESS(IRRADIATED)
X.0	392	NO PLANNED PROCESS(IRRADIATED)
X.0	405	IN COOLING, PRODUCT FEED
X.0	408	IN SEPARATION PROCESS
VII.10	409	NITRATE SOLUTIONS PRODUCT
VI.?	410	NITRATE COMPOUNDS PRODUCT
II.?	450	METAL CHIPS FEED
VII.?	452	NITRATE SOLUTIONS FEED
IV.0	453	IN OXIDE CONVERSION PROCESS
IV.0	454	DIOXIDES PRODUCT
IV.0	455	OTHER OXIDES PRODUCT
IV.?	456	SPECIAL FUELS OXIDE PRODUCT
IV.?	457	CERAMIC GRADE DIOXIDE PRODUCT
??	475	PROCESS FEED MATERIAL
??	480	IN SOURCE FABRICATION PROCESS
XI.3	481	FABRICATED SOURCES PRODUCT
VI.?	572	HYDRIDES PRODUCT
I.0	580	WEAPONS AWAITING DISASSEMBLY FEED
I.0	581	DISASSEMBLY PROCESS
I.0	582	DISASSEMBLED WEAPON COMPONENTS

DOE/MD Category	COEI Code	Composition of Ending Inventory (COEI) Description
??	583	INACTIVE STOCKPILE - DOE CUSTODY
IV.?	635	DIOXIDE POWDER FEED
IV.?	636	IN SINTERING PROCESS
IV.?	637	SINTERED PRODUCTS
II.4	690	UNALLOYED METAL FEED
III.?	691	ALLOYED METAL FEED
VI.?	692	COMPOUNDS FEED
VII.?	693	OTHER OXIDE FEED
VII.?	694	COMBUSTIBLES FEED
VII.?	695	NON-COMBUSTIBLES FEED
VII.?	696	SOLUTIONS FEED
V.1	697(?)	PROCESS RESIDUES
VII.?	697	PROCESS RESIDUES
I.?	699	DISASSEMBLED WEAPON COMPONENTS FEED
VII.10	700	IN RECOVERY PROCESS-UNIRRADIATED
II.4	701	UNALLOYED METAL PRODUCT
III.1	702	ALLOYED METAL PRODUCT
VII.10	703	NITRATE SOLUTIONS PRODUCT
??	704	NITRATE COMPOUNDS PRODUCT
IV.?	709	DIOXIDES PRODUCT
See ANSI.Table	721	UNALLOYED METAL(UNIRRADIATED)
See ANSI.Table	722	ALLOYED METAL(UNIRRADIATED)
See ANSI.Table	725	COMPOUNDS(UNIRRADIATED)
See ANSI.Table	726	COMBUSTIBLES(UNIRRADIATED)
See ANSI.Table	727	NON-COMBUSTIBLES(UNIRRADIATED)
See ANSI.Table	728	SOLUTIONS(UNIRRADIATED)
See ANSI.Table	729	PROCESS RESIDUES(UNIRRADIATED)
XI.3	745	IN/FOR CRITICAL OR SUB-CRITICAL ASSEMBLIES
XI.3	746	IN OTHER R&D USAGE
XI.?	747	IN/FOR NON-DESTRUCTIVE TESTS
XI.?	748	IN/FOR EXPERIMENTAL FUEL FABRICATION
XI.?	749	IN/FOR WEAPONS EFFECT NEUTRONICS MEASMENTS
XI.3	752	IN/FOR WASTE MANAGEMENT R&D STUDIES
VI.?	770	CARBIDES
XI.3	771	SAMPLES & STANDARDS
I.0	772	FINISHED WEAPONS
XI.2	774	EXPERIMENTAL CAPSULES, ELEMENTS, PINS
VI.?	775	HALOGEN COMPOUNDS NOT REPORTED ELSEWHERE
VI.6	776	MISCELLANEOUS COMPOUNDS
??	777	MISCELLANEOUS SOLUTIONS
II.?	778	BILLETS FOR CRITICALITY STUDIES
II.4	779	UNALLOYED ARCHIVE &/OR RETAINED SAMPLE ITEMS
III.1	780	ALLOYED ARCHIVE &/OR RETAINED SAMPLE ITEMS
XI.3	781	SEALED SOURCES
II.4	782	LABORATORY SAMPLES-UNALLOYED METAL
III.1	783	LABORATORY SAMPLES-ALLOYED METAL
VI.6	784	LABORATORY SAMPLES-COMPOUNDS AND GAS
XI.3	785	INVENTORY VERIFICATION SAMPLES
XI.3	788	FISSION DETECTORS
XI.?	789	NUCLEAR ACCIDENT DOSIMETERS

DOE/MD Category	COEI Code	Composition of Ending Inventory (COEI) Description
X.0	790	IRRADIATED MATL FOR FUEL ELEMENT EXAMINATION
VIII.8	791	MATERIAL HELD FOR DISPOSITION
?.?	835	HELD BY DOE CONTRCTRS(RIS A-Q)NMMSS BK INV
XI.3	836	HELD BY DOMESTIC LICENSEES(RIS W-Z)NMMSS BK
I.0	837	HELD BY FOREIGN COUNTRIES(RIS R)NMMSS BOOK
?.?	847	HELD BY DOMESTIC LICENSEES(NMMSS BOOK INV)
?.?	848	HELD BY FOREIGN COUNTRIES(NMMSS BOOK INV)
?.?	849	HELD BY DOE CONTRACTORS(NMMSS BOOK INV)
?.?	860	IN REACTORS & CRITICAL ASSEMBLIES
?.?	861	IN COOLING
?.?	862	IN CONVERSION AND FABRICATION PROCESSES
?.?	863	IN RECOVERY PROCESSES
?.?	864	MATERIAL NOT IN PROCESS
?.?	865	UNIRRADIATED SCRAP AWAITING RECOVERY
?.?	866	UNIRRADIATED SCRAP AWAITING DISPOSAL
?.?	871	HELD BY DOMESTIC LICENSEES(NMMSS BOOK INV)
?.?	872	HELD BY FOREIGN COUNTRIES(NMMSS BOOK INV)
?.?	874	HELD BY DOE CONTRACTORS(NMMSS BOOK INV)
?.?	875	REPORTED BOOK INVENTORY FOR IAEA
I.0	903	HELD IN WAR RESERVE WEAPONS
I.0	905	RETIRED IN PLACE
?.?	906	HELD IN TRAINING CATEGORY
?.?	907	INACTIVE STOCKPILE - DOD CUSTODY
I.0	911	NON-WEAPONS - ARMY
I.0	912	NON-WEAPONS - NAVY
?.?	913	NON-WEAPONS - AIR FORCE
?.?	921	EXPENDITURES
?.?	922	LOSSES
?.?	925	DOD HOLDINGS(NMMSS BOOK INVENTORY)
?.?	931	MILITARY BILATERAL AGREEMENTS (91C)
?.?	932	MUTUAL DEFENSE PURPOSES (91C)
?.?	933	LOSSES FOR 91C MATERIAL
?.?	946	UNIRRADIATED MATERIAL
?.?	947	IRRADIATED MATERIAL
?.?	956	AWAITING DISPOSITION-SOLIDS
?.?	957	AWAITING DISPOSITION-LIQUIDS
?.?	958	STORED RETRIEVABLY-SOLIDS
?.?	959	UNDERGROUND WASTE STORAGE-LIQUID
?.?	960	UNDERGROUND WASTE STORAGE-CALCINED
?.?	961	LIQUIDS TO BASINS, PONDS, PITS, OR CRIBS
?.?	962	BURIED-SOLIDS
?.?	963	BURIAL MATERIAL - (NMMSS BOOK INV)
?.?	971	SCRAP GENERATED ON SITE- 6 MONTH PERIOD
?.?	972	SCRAP RECOVERED ON SITE- 6 MONTH PERIOD
?.?	973	SCRAP RECATEGORIZED ON SITE- 6 MONTH PERIOD
?.?	974	SCRAP DECLARED TO CSMO- 6 MONTH PERIOD
?.?	991	COUNTRY OF ORIGIN OR PRODUCTION
?.?	992	COUNTRY OF ORIGIN OR PROD. (NMMSS BOOK INV)

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